

## **Evolution of a plume-generated segment of the rifted margin of Laurentia: early stage of a Wilson Cycle In operation**

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The southern part of the Canadian Appalachians and the adjacent parts of the craton show a range of distinctive features pertaining to the operation of an early stage of the Iapetan Wilson Cycle. More specifically, the features form a set of signatures reflecting the mechanisms and processes involved in the rift and rift-drift transition stages of a segment of the continental margin of Laurentia. They probably constitute the most coherent set of such signatures known for any one segment of the ancient continental margin. Evidence points to an initial lithospheric rupture in the form of a three-pronged rift, probably induced by a rising mantle plume. Initiation of rifting appears to have been accompanied by the emplacement of tholeiitic diabase dykes, along rifts radiating from the RRR triple junction, ca. 590 Ma ago. The best preserved of these dykes are represented by the E-W trending dykes of the Grenville Swarm, more than 700 km long and injected into the strongly oriented stress field of the nascent failed arm (Ottawa Graben). A protracted (~35 Ma) period of rifting ensued during which alkalic-carbonatitic complexes

were emplaced along the failed arm ca. 575 Ma ago. Approximately 20 Ma after the alkalic-carbonatitic magmatism, a volcanic outburst occurred at the triple junction, probably signalling the onset of a phase of rapid rifting, prior to the initiation of sea floor spreading. Whereas the early rift-related dykes are tholeiites, the late volcanics are mildly alkaline to transitional basalts with minor comenditic lavas and pyroclastics. The former may have formed by decompression melting of the upper parts of cooler mantle of a mushroom-shaped plume head, away from the plume axis, while the latter may have been derived from hotter mantle at the plume axis, beneath attenuated continental crust.

The volcanic outburst was followed by a short period of rift facies clastic sedimentation during which a large delta, of a river that drained the failed arm, formed over the volcanic shield. The beginning of the drifting stage is indicated by the establishment of open marine sedimentation on the continental margin, also in the Early Cambrian, possibly ca. 550 Ma ago.